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Organic livestock production

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The development towards a sustainable agriculture has been a main objective of organic agriculture from the beginning (IFOAM, 1978), and a declared objective of the newly applied EC-Regulation (1804/1999) on organic livestock production which provides a clear framework for livestock production. The leading idea is based on the voluntary self-restriction in the use of specific means of production with the objectives to produce food of high quality in an animal appropriate and environmentally friendly manner within a nearly complete nutrient farm organism (Sundrum, 1998). With regard to an environmentally friendly production, organic livestock farming is characterised by:

- System-oriented approach,
- Renunciation of mineral nitrogen, pesticides, growth promoters, and GMO's,
- Maximum total stocking density of 2 large animal units per ha,
- Restrictions in the amount and quality of bought-in feedstuffs.

In the following, consequences of the framework and the production method are discussed in relation to the environmental issue.

System-oriented approach

Livestock production forms an integral part of agricultural holdings practising organic farming. Different agricultural fields are interrelated into a 'farm organism' which is driven by a nearly complete innerfarm nutrient cycle. A strict separation into lines of production is inappropriate to the idea of a nutrient cycle. With regard to nutrient losses, level of reference is the farm as a single unit and not a specific level of process engineering as is commonly used in conventional production. For example, it would be inappropriate to assess the emission of nitrogen in relation to the average milk yield per cow without taking the whole farm that is among others nitrogen losses in relation to fodder growing and distribution of manure into account.

Prevention strategy

The general renunciation of mineral nitrogen, risk materials (like pesticides) and controversially discussed substances (like GMO's) is part of a prevention strategy, leading to a comparable low input of substances, into the farm and to a minimized output. Reduction of pollution or energy consumption is reached by a systemic and casually related approach, while conventional strategies are often based on technical and management related measures (Kristensen and Halberg, 1997).

To assess nutrient losses on the farm level, the most common methodologies involve using balance sheets of the whole farm. Calculations demonstrate that the systemic effect of organic agriculture in both cattle and pig production has great implication on the nutrient balance and the balance-surplus in relation to the product (Haas, 1995; Halberg et al., 1995; Martinson, 1998; Sundrum & Trangolao, 2000). There is reason for the assumption that the benefit of the system-related approach on minimising pollution are much more effective as compared to management-related factors, such as increasing animal performance per animal per year. For example, reducing nitrogen input of 100 kg N/ha is more than doubly efficient in relation to the balance surplus than increasing average milk yield for 1.000 kg/cow and year (Mejs and Mandersloot, 1993). However, there is a high variability within organic farms in relation to their efforts and their nutrient efficiency.

Dual strategy in relation to nitrogen

In organic livestock production, feeding is primarily based on home-grown feedstuffs, including a high amount of legumes. As a consequence crude protein content in the diet often clearly exceeds the requirements of the animals and nitrogen in the manure is on a high level. In conventional production farmers are asked to reduce nitrogen in the diet in order to reduce nitrogen in the manure. In organic farming, a high level of crude protein in the diet is a very important nitrogen source for the

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innerfarm nutrient cycle. When trying to utilize this nitrogen source, organic farmers are encouraged simultaneously to minimize nitrogen emission from the manure. Due to the limited nitrogen resource, organic farmers have to find the balance within a dual strategy: increasing nitrogen in the manure and minimizing nitrogen emission from the manure. As nitrogen input in the organic farm is on a low level, organic farms are endowed with a credit in relation to nitrogen losses in the following production process. In the long run, the objective to increase productivity within the framework of organic agriculture goes along with improving management measures to minimize nitrogen emission.

On the other hand, the increase of productivity from a high level as being realised in conventional production leads more or less to a higher efficacy of nitrogen turnover and a reduction in nitrogen losses per cow and milk yield (Kirchgessner et al., 1991). However, there is reason for the assumption that with reference to the conventional farm as a whole, nutrient efficacy will probably decrease due to a reduction in digestibility of feedstuffs and higher demands of bought-in concentrates. Those concentrates increase nutrient input in the farm and cause energy consumption especially due to transport. From these theoretical considerations the question arises whether the efforts to increase productivity will reach or even has already exceeded the marginal utility in relation to environmental effects.

It can be concluded that both, a system oriented approach and a approach on the level of process engineering are needed to proceed in environmentally friendly production. Organic livestock production seems to be in the lead because production starts from a comparable low level of nutrient input.

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